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ROBUSTA AND SOME ALLIED COFFEE SPECIES.

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[This paper prepared by Dr. C. J. J. van Hall, Chief of Division of the Department of Agriculture, Buitenzorg, is by his courtesy reproduced below. The success which has attended the cultivation of *Robusta* Coffee in Java and the progress which is being made in that island with other varieties of the *Robusta* group must render the paper of considerable interest to readers in the Federated Malay States. Ed.]

The decline of the Liberian coffee—a consequence of the leaf-disease (*Hemileia vastatrix*)—and the poor crops obtained during many years from Coffea arabica, which must be attributed partly to the Hemileia and partly to the unfavourable seasons, induced planters and Government to try several new species of coffee.

Of the newly imported ones, *robusta* has become very popular and during the last five or six years, a large area has been planted which is becoming more extensive every year.

Three other kinds of coffee, *Quillou*, *Uganda* and *Canephora*, closely related to *robusta* have also received attention and are considered to be more or less promising, especially the *Quillou*; two other members of this same group *Coffea Laurentii* and *Coffea canephora var. Sankuruensis* have been imported recently.

Other species of Coffea, belonging to other groups, have been imported by the Government, but none of these seems to be predestined to play a very important role. The four new species, which belong to the Liberia-group: *Coffea Dewevrei*, *Coffea excelsa*, *Coffea Dybowskii* and *Coffea aruwimiensis*, seem to be all, like the Liberian-coffee itself, too liable to the Hemileia-leaf-disease or from another point of view less promising than robusta and allied species. Another species, *Coffea congensis*, though being quite resistant to leaf-disease, is also of little value, being a weak grower and a poor bearer.

It is true that *Coffea excelsa* and *Coffea Dybowskii* are not so liable to leaf-disease as *Coffea liberica* and probably they will be useful as stock for hybrids.

Characters of the Robusta-Group.

The robusta group has not yet been the object of a thorough botanical investigation. Only *Coffea canephora* and *Coffea Laurentii* have been described; but the author of the descriptions—Dr. Em. de Wildeman confessed,—himself, that he only disposed of insufficient herbarium material and accordingly even these descriptions need revision.

The *Quillou robusta* and *Uganda* have not been described at all, and these names are only provisional; botanical names have not yet been given to these species (varieties).

Still it is hardly contestable that they belong to the same group. The habit of the trees is much alike, they are all early and strong bearers, the fruits are small and arranged in dense clusters, containing sometimes forty and even more fruits; the leaves show rather much variety but they are always larger than in the *Coffee arabica* and more or less of the size of the liberica-leaf, sometimes smaller, sometimes larger, but never of leathery appearance and more soft and weak.

Robusta-Coffee.

Introduction in Java and present position.

Robusta was found in the forests of the Eala district of Belgian Congo by Mr. Luja, one of the travellers of the well-known Brussels horticulturist, Mr. L. Linden, the manager of "l'Horticole coloniale."

The seeds were sent to Brussels and the plantlets, reared in greenhouses, were ready to be sold in 1901. They were introduced by Mr. Linden under the name "Coffea robusta."

Several planters in Java and also the Govenment in the years 1901 and 1902 imported a number of *robusta*-plantlets.

In the beginning the general opinion was rather sceptical about the new coffee, especially the small and irregular beans, which gave a market produce of inferior appearance, and the unfavourable opinion of experts made planters hesitate to plant *robusta* on a large scale.

Gradually however its good qualities were recognised: its early bearing and its large crops, the little liability to Hemileia-leaf-disease, the comparatively little dependency on climatic conditions.

These made its popularity increase quickly. In the last few years large areas have been planted, and at present the *robusta* is of greater importance to Java than any other kind of coffee.

The following figures give the amount in piculs[1] obtained from 1908 to 1912:[2]

	Robusta.	Arabica ("Java coffee")	Liberia.
1908	only a small amount	246.876	87.822
1909	10.508	96.880	110.928
1910	30.265	96.593	76.057
1911	156.498	114.409	64.467
1912	260.000 (estimate)[3]	248.257 (estimate)	61.185 (estimate)

The *robusta* has been principally planted in Java to replace in old fields the Liberia-coffee and the Java-coffee, while also many cacaofields have been replanted with *robusta*; here and there it has been used as catch crop in Hevea-plantations.

Botanical characters and variability.

It was soon remarked that the imported plants and still more the off-spring were not of one uniform type but a mixture of many varieties, which were different in size and shape of the leaves, in size and shape of the fruit, etc.

This makes it difficult to indicate by what characters the whole of these varieties, called robusta-coffee, is to be distinguished from their allies. As general characters we may enumerate: the colour of the fruit, which is vermillion-red when almost ripe, and gets very dark red with a bluish tinge when completely ripe; when unripe the fruits are green and never bronze-coloured; the basal part of the leafblade is emarginate towards the stalk; the young leaves are green not brownish. There are however here and there robusta-specimens which are exceptions to these general rules.

Perhaps two newly imported varieties named *Coffea Laurentii* and *Coffea canephora* var. *Sankuruensis* must be regarded as belonging to the robusta. They were both obtained by intermediacy of the Belgian Government from the Congo.

Soil and climate.

Robusta is not particular about soil and climate. It has been planted with success in heavy as well as in light soils.

It seems however to be more sensitive to soil humidity than many other coffee-species. This is especially apparent on heavy clay-soils. In parts of West Java, where the yearly amount of rain

(1) One picul is 61.76 Kilogr. 133 1/3 lbs.

(2) These figures are taken from the statistics, published yearly by Gyselman & Steup and Lidgerwood Mfg. Coy:

(3) A very large amount of the robusta-coffee produced in Java is consumed locally. The amount exported in 1912 will be about 100,000 piculs.

is large and the soil rather heavy, *robusta* does not grow well, and the same result was noted in Suriname (West Indies) where the soil is very heavy and the drainage imperfect. Where such conditions are prevalent, and where the leaf-disease does not occur, better success is to be expected from coffee species of the Liberica group (*Coffea liberica, C. excelsa, C. abeocuta,* etc.), and also the *Quillou* and the *canephora* seem to be a little stronger in this respect than robusta.

In its mother-country (Congo) *robusta* has the reputation of being unable to resist long droughts. In Java we have not yet seen that *robusta* was weak in this respect. It is true that after a long drought, as was experienced in 1912, the *robusta*-trees had a very poor appearance, but after a few showers they recovered completely speaking generally, no loss of trees of any importance was experienced and the crop for 1913 does not seem to have suffered from this drought.

As regards temperature, beautiful robusta-fields are to be found both in the hot plain along the sea-coast and in the cooler mountains up to 3,000 or even 3,500 feet, but as a rule it thrives best in a medium climate which is to be found, between 1,500 and 2,500 feet (average temperature 22^0—24^0 C.)

Planting distance.

On very fertile soil, where the growth is very luxuriant (virgin soils in Besuki and in the Malang-division), a planting distance of 8 by 8 or 8 by 9 feet is considered appropriate; on less fertile soil a distance of 7 by 7 or 7 by 8 is commonly applied.

When planted as a catch crop between Hevea, a closer distance (6 by 6 feet) is to be preferred, because the plants never attain their full size.

This mixed cultivation has great advantages on plantations, where coffee is also cultivated without Hevea and where the machinery and installations are present to prepare the coffee.

Shade and greenmanuring.

In the first two years, *robusta* does not need much shade, but it is generally accepted as advisable to keep it later well under shade.

When "lamtoro" (*Leucaena glauca*) is used, this shade tree is generally planted at the same distance as the *robusta*, 8 by 8 or 7 by 7, and thinned out later.

The "lamtoro" is also useful as a green manurer; in this case it is sown very closely in rows between the *robusta* and every three months, sometimes even at shorter intervals, it is cut down to about one foot from the soil, the branches and leaves are spread out in the rows of the *robusta*, or they are used for mulching the young plants, or the material is buried.

Another useful leguminous plant for the same purpose is *Clitoria cajanifolia*. Less appropriate are: *Tephrosia* spp. *Indigo* spp. *Crotalaria* spp.

Pruning.

At the present time planters agree that it is not advisable to let the tree grow up without pruning. The trees, when not pruned, attain a height of 20 feet and more. They have a curious habit of bearing only branches at the top and near the soil, with none or almost none at the middle of the stem.

Picking fruit from such trees is difficult and expensive; besides the branches are brittle and easily broken by wind. In low lands unpruned trees have a weak stem which bends down.

It is therefore the general practice to remove the terminal bud, with a knife or thumbnail, when the trees have attained a height of 7 (sometimes 6 or 8) feet, and to keep the tree at this height Thumb-nail pruning of branches is often done with the purpose of sooner obtaining the development of many side branches. Side branches developing from the main branches near the stem are generally removed to obtain an open space around the stem.

There is still some controversy about the question whether it is advisable or not to allow one or a few watershoots to grow up, obtaining in this way two, three or four stems. The most general practice is at the present time to have each tree with two or three stems.

Disease and enemies.

The great advantage of *robusta* is its little liability to the *Hemiliea* leaf-disease. It is however not completely immune and when grown under unfavourable conditions, especially on poor soil, the *Hemiliea* sometimes badly attacks the *robusta*.

When however the cultural conditions are good, the *robusta* suffers very little from *Hemiliea*. Some specimens however show a liability, which is quite individual and it is not an uncommon sight to see here and there one tree covered with the *Hemilica*-spore amidst others which are quite free from leaf disease. Such specimens have to be removed.

The American leaf-disease (caused by *Cercospora Coffeae*) is a common disease on *robusta*. Especially in nurseries the young plants often suffer severely and even sometimes die. Spraying with Bordeaux mixture is a reliable remedy.

Of less importance are the *Colletotrichum*-leaf-disease and the *Ascospora*-stem-disease, Root-disease (*Fomes*) is in some places troublesome.

Of insects the "bubuk" (*Xyleborus compactus*) is sometimes the cause of the loss of many branches; but it has always been seen, that, after a strong attack, the Xyleborus disappears without special measures having been taken. Apparently the Xyleborus is kept in check by its natural enemies, of which a small Hymenopteron (Chalcidid) seems to be the most important.

An Anguillulide (*Tylenchus acutocaudatus*) renders in some places robusta-culture almost impossible. Happily this enemy is not very common and is confined to special regions.

In the last few years the small caterpillar of a Microlepidopteron, belonging to the family of Tineidae, have done ravages in the blossoms and the clusters of young fruit. In the dry season after blossoming, in the months, June to July and August, this enemy has been very troublesome in many plantations.

Yield.

The yield is quite variable and depends much on the fertility of the soil.

The highest yields are obtained on virgin soil in Besuki and on the mountains in the Malang-division.

As an example of a high yield, obtained per acre on such soils may be considered.

1st year after planting —
2nd ,, ,, ,, a little.
3rd ,, ,, ,, 5 cwt.
4th ,, ,, ,, 13 cwt.
5th ,, ,, ,, 17 cwt.

In old Liberia or cacaofields the yields are not so high; the following is an example of a very satisfactory yield on a soil, cultivated already for many years under coffee or cacao and replanted with robusta:—

1st year —
2nd ,, —
3rd ,, 3 cwt. per acre
4th ,, 5 cwt. ,,
5th ,, 8 cwt. ,,

Preparing and curing.

The *robusta* needs a long fermentation in consequence of the little development of the pulpy substance, which is comparatively difficult to remove.

A fermentation lasting about two days and a half is considered necessary. The drying is done in a drying house which is heated beforehand. The robusta bean needs very quick drying in order to loosen the silverskin.

Robusta has the advantage of losing very little in weight by being prepared and dried. While in Liberia coffee the proportion is 1 : 10, by *arabica* 1: 5½ to 6, *robusta* has an average proportion of 1 : 4½.

Also in this respect the different types of *robusta* show much variation. As extremes may be considered 1 : 3½ and 1. 5½.

This favourable proportion is principally a consequence of the small amount of pulp round the seed.

Qualities of the marketable bean.

The appearance of the average marketable *robusta* is not very beautiful; the beans are small and irregular and the average produce shows little uniformity.

There are however great differences between the many different types of *robusta*. Some of them have comparatively large beans. larger even than *arabica*, others again have very small ones.

As regards the quality, though being inferior to Java-arabica, the taste is generally considered to be good and superior to the ordinary *arabica* sorts, as Santos.

In February 1912 an important decision was taken by the Board of managers of the Coffee Exchange of the City of New York who decided in a special meeting to boycott the *robusta* from the American market.

This measure seems to have been a consequence of the anxiety of coffee merchants in view of the possibility that *robusta* coffee, if " tendered for delivery on a contract on the exchange, might have " to be accepted in such a contract, while it is considered an un- " desirable property owing to its status as a poor seller " (9th. Annual Report of the Nederland Chamber of Commerce in America).

Certainly the unfavourable opinion about *robusta*, which the American coffee merchants volunteer in their reports, is quite different from the opinion of the European experts, and it is very probable that they only regard the *robusta* as a dangerous competttior of the Santor-coffee, over which the American merchants have a control, while the robusta-imports are not under their control.

For the present it is difficult to say in how far the robusta-market in Europe will be influenced by the American decision.

Quillou-Coffee.

Quillou-coffee is a variety closely related to *robusta*. It was obtained in 1901 by the Government from the Jardin d'Essai at Libreville (French Congo).

It is slightly different from *robusta*. The colour of the fruit is bright red, not dark red as in *robusta*; the " silverskin " of the seed is brown, not greyish as in *robusta*; the colour of the leaves is a

little lighter green than in the robusta-leaves and when quite young their colour is brownish or rusty.

The *Quillou* is more uniform and does not contain so many types as *robusta*.

Quillou has only attracted the attention of the planters during the last four or five years, and this on account of the high yields obtained at the Government Experiment Plantation at Bangelan.

In these last few years *Quillou* has been planted on several estates but generally only on a small scale. It begins however to become more and more popular and many planters give it the preference to *robusta*.

On heavy soils *Quillou* seems to give higher yields and to be earlier productive than *robusta*. On light sandy soils however it is not such a good bearer and *robusta* is to be preferred.

In other respects *Quillou* behaves much like *robusta*.

Canephora.

Under the name *Coffea canephora* plants were imported in 1902 and 1903 from the Kew Gardens, from the Jardin colonial (Nogent sur Marne) and from "l'Horticole coloniale" (Brussel).

Like the fruit of *Quillou* the fruit of *Canephora* is light red or vermillion red, never dark red or bluish when ripe; when very young the fruit has a bronze colour. Characteristic is the form of leaf which is not emarginate towards the stalk, like the robusta-leaf, but gradually tapering and comparatively narrow: the borders of the leaf are not undulating, as in many robusta-types, but flat.

The *canephora*-coffee has one great drawback *viz.* its liability to Hemileia leaf disease. This makes it unfit for countries where this disease is prevalent.

Sometimes no attack of leaf disease is to be seen in the first few years, but after a heavy crop the plant is often suddenly attacked.

In countries, where Hemileia is not present, *Coffea canephora* may be a recommendable crop, so in Suriname for instance where it seems to grow better than robusta on the very heavy clay soil.

A variety from Madagascar, obtained in 1908 from the French Government, seems to be identical with the ordinary *canephora* from the Congo.

As mentioned, another coffee-variety, obtained in 1907 under the name *Coffea Canephora var. Sankuruensis* from the Belgian Congo seems to be more a robusta-type than a canephora-variety.

Uganda Coffee.

This is a coffea with small undulating leaves and light red coloured fruits. It was obtained in 1903 from Dar-es-Salam.

Little positive data are available about Uganda coffee. In the Experimental Garden near Buitenzorg, where *robusta* always has a poor growth and a small yield, Uganda succeeded better, but on the estates did not answer the expectations and it is generally considered to be a rather poor bearer.

Coffea Laurentii.

The fruits of this coffee are dark, bluish red and the broad leaves have the same shape as the leaves of many robusta-types.

It was obtained in 1907 from the Congo, by intermediacy of the Belgian Government.

It has not yet been tried on a large scale.

Buitenzorg, 11 September, 1912.

A LIST OF FUNGI IDENTIFIED IN THE FEDERATED MALAY STATES WITH NOTES ON THEIR OCCURRENCE.

BY Keith Bancroft.

Erysiphaceæ,

Erysiphe Polygoni, D. C.
" mildew " on tomatoes, cucumbers, &c., at Maxwell Hill, Taiping.

Perisporiaceae.

Asterina tenuissima, Petch.
on green stems and fruits of *Hevea*

Brasiliensis; said by Petch to live on the sugary secretions of the nectaries at the base leaves.

Limacinula javanica, v. Hohnel, on leaves of *Hevea* following on a scale, *Lecanium nigrum*.

Eurotium candidum, Speg.
a common mildew on prepared rubber.

Meliola Palmarum, Kunze and Fr.
a " sooty mould " on leaves of coconut.

Monascus heterosporus, Schroter.
causing a spotting of prepared rubber.

Sphaeriaceae.

Eutypa caulivora, Massee.
on trunks of *Hevea*; a " wound parasite."

Laestadia Theae, Rac.
on leaves of *Thea* in Negri Sembilan; cause of "copper blight " of tea-plant.

**Sphaerella Camilleae*, Cooke.

Laestadia Palaquii, Bancroft.

parasitic on leaves of *Palaquium oblongi folium* at Trolak (Perak).

Trabutia Stephaniae, (?)

on leaves of Merabau (*Afzelia retusa*) Perak.

Xylaria cynoglossa, Cooke.

on a dead root of *Hevea*.

Xylaria scopiformis, Mont.

on dead wood, Perak.

Xylaria holobapha, Berk.

Maxwell Hill; 2500 ft.

Poronia oedipus, Mont.

Upper Perak, 550 ft; on dead wood.

Daldinia concentrica, Ces. et De Not.

common on dead wood. Malay "Chendawan jemput-jemput;" said to be poisonous.

Hypoxylon oodes, B. & Br.

on dead branches of *Hevea*, Selangor and Perak.

Nummularia pithodes (B. & Br.) Petch.

common on dead branches and trunks of *Hevea*; regarded by Petch as identical with *Eutypa caulivora*, Massee.

Thyridaria tarda, Bancroft.

the perfect stage of *Diplodia*, cause of "die-back" disease of *Hevea*.

HYPOCREACEAE.

Nectria diversispora, Petch.

the common red *Nectria* on dead parts of *Hevea*: saprophytic.

Sphaerostilbe coccophila, Tul.

following on a scale on lime (*Citrus medica*); parasite on scale.

Megalonectria pseudotrichia, Speg.

common on dead wood.

Balansia sessilis, Massee.

on inflorescence of *Ichnanthus sp.* Johore, (Ridley).

Balansia asperata, Massee.

on inflorescence of *Ichnanthus palleus*, Johore, (Ridley.)

DOTHIDEACEAE.

Dothidella Pterocarpi, Massee.

parasitic on leaves of Sĕna, *Pterocarpus indicus*, Kuala Lumpur.

UREDINACEAE.

Uredo Imperatae, P. Magn.
on *Imperata arundinacea* (lalang), Selangor.
Hemileia vastatrix, Berk. & Br.
parasitic on leaves of *Coffee Liberica*, *C. robusta*, *Gardenia spp.*, Selangor, Perak, Negri Sembilan, Kelantan.

USTILAGINACEAE.

Ustilago virens, Cooke.
parasitic on grains of rice, Krian, Perak.

TREMELLACEAE.

Hirnecolà polytricha, Mont.
common on dead wood ; used in making curry.
Guepinia flabellata, Cooke.
Common on rotten logs.
Guepinias spathularia, Fr.
common on dead logs.

CLAVARIACEAE.

Lachnocladium furcellatum. Lév.
on dead wood ; Upper Perak, 300 ft.

THELEPHORACEAE.

Corticium salmonicolor, B. & Br.
cause of pink disease of *Hevea*.
* *Cladodèrris dendritica*, Pers.
* *Cladoderris spongiosa*, Fr.
* *Stereum Mellisii*, Berk.
* *Stereum lobatum*, Kunze.
* *Stereum aterrinum*, Cooke.
* *Stereum involutum*, Kl.
Hymenochaete noxia, Berk.
causing brown root disease of *Hevea*, coffee, camphor, &c.
Hypochnus sp.
" thread blight " fungus on *Hevea*, &c.

HYDNACEAE.

Irpex flavus, Klotsch.
on dead wood ; said to cause a root disease of *Hevea*, Cloves and Coffee.

POLYPORACEAE.

Fomes semitostus, Berk.
cause of common root disease of *Hevea*.
Fomes amboinensis, Fr.
on dead wood ; common in jungle " clearings," Selangor and Perak.

Polystictus sanguineus, Fr.
common on dead trunks, Selangor, Perak, Negri Sembilan Johore. Malay "Chendawan biring."
Polystictus stereinus, B. & C.
Manwell Hill, 3000 ft; on dead wood.
Polystictus mutabilis, B. & C.
on dead logs, Perak.
Polystictus xerampelinus, Kalchb.
Polystictus hirsutus, Fr.
on dead stumps of Angsana; common on dead wood; Selangor.
Polystictus occidentalis Kl.
on dead stumps of Angsana, Penang.
* *Polyporus hemicapnodes, var dimorphus*, Berk.
* *Polyporus rugosus*, Nees.
* *Polyporus xanthopus*, Fr.
* *Polyporus flabelliformis*, Kl.
* *Polyporus affinis*, Nees.
* *Polyporus incurvus*, Cooke.
* *Polyporus cornubovis*, Cooke.
* *Polyporus senex*, Berk & Mont.
* *Polyporus introstuppeus*, Berk & Cooke.
* *Polyporus australis*, Fr.
* *Polyporus kermes*, Berk.
* *Polyporus Auberianus*, Mont.
* *Polyporus Thwaitsii*, Berk & Br.
* *Polyporus arenosus*, Cooke.
* *Polyporus caliginosus*, Ces.
* *Polyporus cingulatus*, Berk.
* *Polyporus aratus*, Berk.
* *Polyporus cinerascens*, Fr.
* *Polyporus burnneo-pictus*, Berk.
* *Polyporus substygius*, B. & Br.
* *Polyporus submembranaceus*, Berk.
* *Trametes rigida*, Berk.
Favolus Brasiliensis, Fr.
on dead wood, Upper Perak.
Favolus scaber, B. & Br.
* *Hexagonia tenuis*, Berk.
* *Dædalea sanguinea*, Klotsch.

AGARICACEAE.

Lepiota procera, Scop.
on the ground, Selangor; edible; Malay "Chendawan susu-pelandok."

Marasmius rotalis, B. & Br.
Selangor and Perak; mycelium resembling horse-hair. Occurs at base of *Hevea* stems.
Lentinus exilis, Kl.
on fallen trunks, Selangor, Perak and Negri Sembilan; Malay "Chendawan batang."
* *Lentinus dactyliophorus*, Lev.
* *Lenzites platyphyllus*, Cooke.
* *Lenzites applanata*, Fr.
Schizophyllum commune, Fr.
common on dead timber.
Agaricus campestris,
Selangor; on pasture land; edible.

PHALLACEAE.
Dictyophora phalloidea,
Malay "Chendawan telekong."

LYCOPERDACEAE.
Scleroderma flavocrocatum. (?)
Malay "Chendawan tumbong kelapa."

SPHAEROPSIDACEAE.
Phyllosticta ramicola, Petch.
causing a stem disease of *Hevea*.
* *Phyllosticta Heveae*, Limm.
parasitic on leaves of *Hevea*.
* *Phoma Camilleae*, Cooke.

MELANCONIACAE.
Gleosporium Mangiferae, Noack.
common on fruits of mango; parasitic.
Gleosporium Musarum, Cke. & Massee.
common on ripe fruits of banana.
Gloeosporium alborubrum, Petch.
on dead shoots of *Hevea*.
Colletotrichum Theae, Massee.
parasitic on leaves of *Thea*, Negri Sembilan.
Pestalozzia Palmarum, Cooke.
causing a leaf disease of coconut.
Pestalozzia Guepini, Desm.
causing a leaf disease of *Hevea*.
Pestalozzia leucodisca, Penz & Sacc.
on leaves of jungle plant, Selangor.

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*Collected in Perak under superintendence of Dr. Geo. King and named by M. C. Cooke.

MUCEDINACEAE.

Oospora gilva, Berk.
common on recently burnt wood; Malay " Bunga Api."

DEMATIACEAE.

Penicillium glaucum, Link.
a common "mildew."

Cercospora personata, Ellis.
parasitic on leaves of ground-nut (Arachis hypogaea), Selangor.

Cercospora beticola, Sacc.
parasitic on best and spinach, Maxwell Hill, Taiping.

Cercospora Cearae, Petch.
parasitic on leaves of Ceara (*Manihot*,) on leaves of Tapioca.

Spondylocladium maculans, Bancroft.
causing a spotting of prepared rubber.

Helminthosporuim obovatum, Massee.
on leaves of Angsana, Selangor.

STILBACEAE.

Stilbella Hevea, Limm.
on trunk of *Hevea*; saprophytic.

THE WATERING OF TAPPING CUTS.

[The following notes on the watering of cuts have been written by a planter who prefers to remain anonymous. The results of his experiments are somewhat surprising, and we publish them in the hope that other planters will carry out similar tests. It is difficult to assign a cause for the results obtained, and therefore it is desirable to find out whether similar results will be obtained in other districts. ED.]

In some systems of tapping para rubber trees, the latex often has to travel a distance of many feet from the point at which it exudes from the bark until it reaches the spout from which it drops into the collecting cup. It would apparently be advisable to pour a a little water at the top of each cut to help the latex on its journey.

A large number of estates however have now adopted the "single V" system of tapping. Using this system it is practicable to affix the spout in the tree within a few inches from the bottom of the excision, and the latex has not to flow a long distance before it drops into the cup. It is still however a common practice to pour water on the cuts.

One argument in favour of this practice is that in the case of some trees and at some seasons of the year the latex coagulates on the cut without running, and if water is poured on the cut, a certain

quantity of latex, at all events, is carried into the cup. It is true that a quantity of latex will be carried into the cup sufficient to make the water opaque, but if such water or latex (whichever one chooses to call it) be examined, the amount of rubber contained in it will be found to be small: a rubber estate that relies for its output on the quantity of latex washed down into the cups in this way will scarcely create fresh records of production: the big outputs are obtained from fields where a fair proportion of the trees go on dripping for an hour or more after they have been tapped.

Again it is argued that pouring water on the freshly excised cut tends to retard the coagulation of the exuding latex. The bark excision may be likened to a surface cut in human flesh: in the latter case the blood flows out until it coagulates and thus forms a scab which heals up the wound: so in the case of a rubber tree the latex appears to exude until, solidifying, it chokes up the lactiferous tubes and forms scrap. A small quantity of water is often poured into the cups in order to prevent the latex coagulating before it is lifted to be taken to the factory: and it is true that, when latex drips into a dry warm cup, it does tend to coagulate where it comes in contact with the surface of the cup. So, if one puts water into the cups to retard coagulation, it seems fair reasoning to assume that water poured on the cuts will also retard coagulation.

Observation appears to show that on rainy mornings, when the bark is wet, the latex tends to clot more quickly, even though the spouts go on dripping for quite as long if not longer than usual. If however the milky fluid that is dripping down be examined some time after the tree has been tapped, it will be found to contain very little latex: on a dry morning on the other hand the last slow drops that fall with perhaps an interval of several minutes between each will be found to be particularly rich in rubber, just as the strippings of a milch cow are rich in butter fat.

Some planters are beginning to question the advisability of watering the cuts, and to carry out experiments on the subject. I now record the results of a couple of experiments initiated by me. It is not for one moment claimed that these conclusively settle the question, but they are put forward in the hope that other planters may thereby be induced to record similar experiments for comparison.

In the first experiment two adjacent trees were selected, both the same size, the same age, and in no way abnormal. They were both twenty five inches in circumference at three feet from the ground, had been tapped for about twelve months on a single V, and the tapping was as nearly perfect as it is possible to get tapping. One had been tapped to within six inches from ground level and the other an inch or so less. Every day for a month the time was noted

when each tree was tapped and when it ceased to drip. For half the month the drops of latex from one tree were dotted down and counted, and for the other half of the month the drops from the other tree were similarly counted. The cuts on these trees were watered on alternate days, so that each day one tree was watered and the other left to run without assistance. At the end of the month the results were averaged out, omitting days that were in any way abnormal. Dealing in round numbers it was found that, when the cut was watered, the tree continued to drip for eighty one minutes, when the cut was not watered, for one hundred and two minutes: that when the tree was watered it yielded 250 drops, when not watered 510 drops.

In considering these results it must be remembered that, when water was poured on the cut, the latex then on the cut was all carried down into the cup, and for a short period latex would discontinue to drip. The latex flowing down with the water would not be counted in, so that the difference would really be less than is shown by the figures obtained by counting the drops. On the other hand the careless application of water in practice often causes a certain amount of rubber to be lost owing to the latex spilling from the cut and trickling down the bark of the tree.

The second experiment was carried out on two lots each comprising nine hundred trees. These trees are young, only recently opened for tapping, and the field does not ordinarily give a big yield. Only No. 1 latex was included: scrap and cup washings were disregarded as being constant factors. The first lot of nine hundred trees, tapped for a period of five days with water poured on the cuts, gave a total output of sixteen pounds: tapped for a further period of five days without water being poured on the cuts, it gave an output of eighteen and a half pounds. The second lot of nine hundred trees tapped for the first period without water gave an output of twenty four and a half pounds: tapped for the second period with water it gave an output of twenty and a half pounds.

This would appear to show that one thousand trees would give about three quarters of a pound less rubber a day if water were poured on the cuts than they would give if the cuts were not watered.

THE BAMBARRA GROUND-NUT (VOANDZEIA SUBTERRANEA).

By F. G. Spring.

A number of these seeds were received from Mauritius in September 1911, and have since been under cultivation at the Experimental Plantation, Kuala Lumpur,

The fruit is somewhat similar to the ordinary ground-nut (*Arachis hypogaea*) but is shorter, more rounded and as a rule only contains one seed. The fruit is not developed on long trailing branches as is the common ground-nut but closely around the principal stalk.

Although it closely resembles *Arachis hypogoea*, *Voandzeia* is described as belonging to a different tribe of Leguminosae being more closely allied to the Haricot bean. These nuts have been grown at Kuala Lumpur with considerable success both in nursery beds and amongst young rubber. The seeds of the first and second crop were equally as good as those received from Mauritius. Bambarra is more commendable as a catch crop in rubber clearings than any other ground-nut I have tried as the nuts are developed at a smaller depth in the soil, a matter of 1 to 2 inches, and are therefore harvested without any damage being done to the rubber roots and at a smaller cost. It is unnecessary to dig out the nuts as the plants, with the nuts attached, can be pulled up by hand.

The Spanish Pea-Nut, Pondicherry, Small Japanese, Senegal, Mozambique and Tambo ground-nuts have also been grown at the Government Plantation, Kuala Lumpur, but not with as much success as Bambarra. This is in all probability due to the latter being able to mature in this country at any season of the year while the other varieties mentioned only produced fairly well developed seeds when harvested in dry weather, and this is difficult to arrange on account of the irrgularity of the seasons.

The varieties, other than Bambarra harvested in wet weather gave very poor results, the majority of the seeds rotting before reaching maturity.

As regards the effect Bambarra would have on the growth of the rubber I do not think it would retard it but rather tend to stimulate growth as the surface soil would be kept in good tilth and in a damp condition. No other ground-nut, as far as I know, can be harvested with such ease, requires so little care in its cultivation and is as suited to the Malayan climate as Bambarra, while according to the results of experiment none of the other varieties grown are so well adapted for a catch crop in rubber. The only danger in using this ground-nut as a catch crop, as with any other ground-nut is the liability of pigs entering the clearing in which they are grown, which in burrowing for the nuts may destroy the roots of the rubber.

The Tropical Agriculturist, June. 1911, states that "The yields obtained from the Bambarra ground-nut are at least equal to and generally greater than those from the ordinary ground-nut. It is an interesting fact that the composition of the Bambarra ground-nut very closely approaches that of an ordinary normal food ration. Even alone it constitutes a complete food, so that, unlike the others

it does not, from this point of view, require mixing with additional foodstuffs, in order that it may present the chief food bodies in proper amounts. The uses of the plant include the employment of the nut for food, both for human beings and stock; the uses of the leaves as fodder; and the provision by them, either when fresh or dry, of a green manure. When the seed is cooked before it is ripe, it gives a starchy, nitrogenous vegetable, which is much liked, possessing as it does a very agreeable taste somewhat like that of the chestnut. When it is ripe and dry, it may be cooked in the same way as beans and lentils; it does not contain, however, as high a percentage of proteids as these foods. When ground, it yields a very white meal from which excellent broth and many soups may be made. Where the fruits are produced in large numbers, they may be used as food for stock; in this case the fact that the covering is consumed as well as the seed gives the product an additional nutritive value."

Cultivation.

The area selected should be flat or undulating but not too steep and as far as possible free from timber. The land must be changkolled or forked to a depth of about 7 inches and the surface soil brought to a fine tilth by breaking up the lumps of earth. The method of planting is similar to that for the ordinary ground-nut. The nuts are shelled and the seeds sown at distances of 18 inches apart each way and at a depth of about 1 inch. Although planting, in this country may be done at any time it is advisable to sow at the commencement of the wet season; this is absolutely necessary when planting varieties other than Bambarra. Little after cultivation is necessary beyond weeding, but this must be most carefully done so as not to interfere with the nuts which are developed at a very small depth under the soil. The nuts are collected when the leaves begin to wither or a little sooner if it is desired to consume them while still green. If they are required for seed purposes they should be well ripened before harvesting. If the seed has to be kept for any length of time it should be well dried in the sun before being stored.

A NOTE ON THE POSSIBLE OCCURRENCE OF A BACTERIAL DISEASE OF HEVEA.

By E. Bateson.

Some little time ago a batch of diseased rubber trees was sent to the Agricultural Dept. from an estate in Perak. All the trees had been killed by the well-known diseases of Hevea, with one excep-

tion, in which no trace of any of the common root or branch diseases could be found. This was a young tree which had not been long in tapping. It had been grown in a sandy soil, with a substratum of clay, which retained water, three feet below the surface.

The manager of the estate, in describing the symptoms, stated that the leaves on the lower branches suddenly died, and looked as if they had been scorched by fire. The disease rapidly spread upwards, and within three days the whole of the leaves were dead. He had previously noticed another tree with apparently the same disease. In this case the latex ceased to flow after a week, and the roots were dry like tinder.

On examining the tree in the laboratory it was found that the wood was discoloured to a depth of about an inch. The discoloration, as could be seen with the naked eye, was most evident in the neighbourhood of the vessels. In the outer quarter inch of wood these were a dark brown, and the discoloration had extended a little way into the surrounding tissues. Beneath this outer layer the vessels were of the normal colour.

Under the microscope it was seen that the vessels were filled with bacteria, which were embedded in a mucilaginous substance. The bacteria oozed freely from the sections. They were short straight rods, less than one thousandth of a millimetre in length, and were non-motile.

There was no difficulty in obtaining pure cultures of the bacterium. Cultures were made in the first place by cutting out small pieces of the wood with a sterilised knife, washing them in mercuric choloride solution (1 in 1,000) to kill foreign organisms which might have adhered to the surface, and placing them in tubes of nutrient media. Pieces of the outer darker wood gave no results, but from pieces of the inner wood there was a rapid growth of bacteria in beef-bouillon agar, and a much slower growth in cane-juice agar. Poured plates were made of beef-bouillon agar. The colonies obtained were round, white in colour with a raised central spot. The superficial colonies grew much more quickly than the deeper ones.

The symptoms described above all correspond with what would be expected of a bacterial disease. It cannot be taken for granted, however, that any organism is a parasite unless the disease can be reproduced in other plants by artificial infection. Experiments were carried out with the bacterium in question on rubber seedlings and young trees from a year to two years old.

Material for the inoculations was obtained in the first place by shaking up pieces of the wood in sterilised water. The infected water was then introduced into some plants by needle pricks on the leaves, and into others by injection into the stem with a hypodermic syringe. In other cases the water was poured round the roots.

A plate culture of the water was made, and was found to give a good growth of the bacterium. Other inoculations were made later with bacteria from the pure cultures obtained on poured plates.

The experiments all gave negative results, and the plants remained alive and healthy, and it was therefore not proved that the bacterium was a parasite. On the other hand, the failure of a limited number of inoculations cannot be taken to prove the reverse, that the organism was not a disease-producing one, as it is quite possible that the conditions were in some way unfavourable to its development.

While there is any doubt on the point it is advisable that planters should be put on their guard, and it is with that object in view that this note has been written. Bacterial diseases, once they have gained a footing, are extremely difficult to deal with, and as they are often carried from diseased to healthy plants by insects, their spread is apt to be very rapid. An example of their deadliness is afforded by the coconut bud-rot, which is attributed by American investigators to a bacterium. It has caused extensive destruction throughout the Western tropics, and in some places threatens to wipe out the cultivation.

If a bacterial disease of rubber trees does exist in this country it is advisable that it should be dealt with before it has become wide-spread, and should planters observe any diseased trees whose symptoms appear to correspond with those described above, they are recommended to cut them out and send them to the Department of Agriculture for examination.

NEW SOURCES OF PAPER.

(Hedychium coronarium, Koen., and allies*).*

The following article is quoted from *Bulletin* (No. 9,—1912) of the Royal Botanic Gardens, Kew. It appears from this report that *Hedychium coronarium*, which is a native of India and Malaya, is likely to prove valuable as a paper making material. The paper made from this plant is superior in strength to the strongest Manila paper and in addition to its strength possesses parchment qualities without sizing or special treatment.

This is especially interesting as there are a large number of Zingiberaceous plants growing abundantly all over this country, and in addition to *H. coronarium* and *Alpinia nutans* there are a number of other species belonging to these genera very abundant in the jungle all over the Malay Peninsula. These if tested may prove to possess paper making qualities equal to *H. coronarium* and may pay to collect or even to cultivate on a commercial scale :—

Early in the present year Messrs. Clayton Beadle and Stevens, of London, drew the attention of Kew to the value of *Hedychium coronarium* as a source of material for paper-making.

This plant, a member of the Natural Order *Zingiberaceae*, is a native of India being distributed from the Himalayas to Ceylon and Malacca, ascending to 4000 ft. in the Khasia Hills and 6000 ft. in Ceylon. It is also recorded from Central America, the West Indies, New Zealand, Mauritius and West Africa (Corisco Bay). Many years ago it appears to have been introduced into Brazil and it has run wild in many of the States.

The genus *Hedychium*, of which a good description by Baker is to be found in Hooker's Flora of British India, vol. vi., p. 225, is characterised by the horizontal tuberous rootstock, which bears the erect elongated leafy stems. The leaves are distichous, oblong or lanceolate, with long clasping sheaths. The inflorescence forms a terminal spike.

In Brazil the plant is described as growing spontaneously and thickly and completely covering the land. The stems are said to reach a height of 1-1½ metres when growing thickly and to be about 2-4 cm. in thickness. On the margins of streams, however, the stems grow as high as 2 metres. After cutting down the stems it is found that some 4-5 months must elapse before a full growth of fresh stems is made.

In order to make certain of the identity of the Brazilian plant whose paper-making qualities had been tested, application for specimens was made to H.M. Consul at São Paulo for specimens of the plant. Thanks to the kind services of the Acting Consul and H.M. Vice-Consul at Curityba, a specimen of the plant known in that region as *Hedychium coronarium* has been received at Kew. This proved to be *Hedychium coronarium*, as did also the specimens sent to Kew by Messrs. Clayton Beadle and Stevens from Parana.

The value of the plant for paper-making was brought to our notice in a request for fresh material for the purpose of experimental investigation. Messrs. Beadle and Stevens had already satisfied themselves as to the good qualities of Hedychium fibre from the dried material they had received from Brazil, and were naturally anxious to test it in the green fresh condition. The paper-making qualities of the fresh material supplied from Kew were found to be identical with those of the dried stems, and the plant appears likely to be a very valuable source of material for the paper-maker.

In a letter to Kew, Messrs. Clayton Beadle and Stevens write:—

"Papers produced from this fibre have even greater tensile strength than the strongest manila papers produced. The strongest manila papers have a strength of 6000 or 7000 metres 'breaking length.' This paper has from 9000 to 10,000. Its elasticity and

folding qualities are exceptional. Moreover, it can be made to bear ink and possess parchment qualities without any sizing or other special treatment.

"The reason of this we find to be due to the presence of the cells associated with the fibre, which are of a semi-gelatinous nature, when chemically treated, and dry into the interstices of the paper and produce natural parchment.

Messrs. Clayton Beadle and Stevens recently presented a paper to the Eighth International Congress of Applied Chemistry* on the paper-making qualities of *Hedychium coronarium* and the following extracts are taken from a copy of the paper sent to Kew by the courtesy of the authors.

A chemical analysis of dried specimens as received was made with the following results :—

"A. Whole stem as gathered.

B. Whole stem after passing through crushing-rollers.

	A	*B*
Moisture	9·7%	11·2%
Ash	4·5	4·8
Cellulose	43·0	48·0
Extracted by chemical treatment	42·8	36·0
	100·0	100·0
Cellulose air dry on air dry allowing for losses	41·0%	44·0%

"Raw material in the form of B is conveniently treated by boiling with 5 per cent. of soda at a pressure of three to five atmospheres. On washing this material, the yield of boiled product including all the fibrous constituents of the plant, is 60 per cent. The peculiar characteristics of the pulp are largely due to the presence of the oval cells of the pith, which is included in the above 60 per cent. If these are removed by washing, the yield of fibre proper is 50 per cent. of unbleached material on the raw weight.

"We discovered that the pith cells, which can be retained or not, according to requirements, possess very peculiar qualities. If taken alone, the unbleached cells when dried down go to a horny mass which can only be broken with very great difficulty with a hammer, and are softened only with difficulty when boiled in soda. If retained in the paper, they give it parchment-like properties to an extraordinary degree. They also render the paper ink-bearing without

* The paper-making qualities of *Hedychium coronarium* represented from Original Contributions, Eighth International Congress of Applied Chemistry, vol. xiii, pp. 39—45.

the addition of any sizing material. . . . . On the other hand, the paper made from *Hedychium* from which the cells are removed is of a soft nature and of medium strength, but that in which the cells are retained, as will be seen, gives higher 'breaking lengths' than any manila paper that we have so far had the opportunity of examining. The oval cells, therefore, 'parchmentize,' strengthen and size the sheet.

"The pulp, after boiling in soda and beating, if examined under the microscope in the presence of chloriodide of zinc shows :—

(*a*) Oval cells stained blue.

(*b*) Long wide fibres something like chemical wood, stained blue.

(*c*) Numerous shorter and solid-looking fibres, stained yellow.

(*d*) Small epidermal cells attached to one another, stained yellow."

The length of fibres is given in a table which is not reproduced here. The means of the results of measurements under the microscope of numerous fibres are as follows :—

"1. Hedychium fibres, unbleached, not beaten, 2·61 mm.

"2. Hedychium bleached, not beaten, 2·56 mm.

"3. Hedychium cells washed through 70-mesh wire, measured lengthwise, 0·138 mm.

"4. Hedychium cells washed through 70-mesh wire, measured crosswise, 0·083 mm.

"5 Best strong thick manila cable paper, 2·835 mm.

"6. Ditto, thin, 2·89 mm.

"It will be observed that the mean size of the cells, taking the mean of the two directions [mean of 3 and 4], is 0·11 mm., or less than 1/20 of the length of the fibres which measure 2·58. It can be understood, therefore, that such small particles as the oval cells will pass through a 70-mesh sieve of the washing drum, the holes of which would be about 0·2 mm., but the same sieve would of course retain the fibres proper. It will be observed also that the mean length of the fibres of the longest and strongest manila papers, which is about 2·85 mm., is only slightly in excess of that of the *Hedychium* fibre, but, as will hereafter be seen, the *Hedychium*, on account of the peculiar nature of the fibres and the cells, is capable of producing a stronger and in many respects more serviceable paper. Moreover, the smallness of the *Hedychium* cells in comparison with the fibres enables the cells to fill the interstices between the fibres. Moreover, these cells, being of a flocculent, sticky and glutinous nature, act as a natural sizing material. We mechanically separated and weighed the cells and fibres with the following results :—

"The actual amount of fibre proper and cells in *Hedychium* unbleached paper, the cells of which have been entirely retained, we find to be as follows ;—

Cells	...	...	17·3%
Fibre	...	...	82·7

"When the pulp is completely bleached so as to produce a white paper, the proportion by weight of cells and fibres in the finished paper is as follows :—

Cells	...	...	14%
Fibre	...	...	86

"We have made several trials of this material on the paper machine. The beaten fibre, especially that containing the pith cells, when left in an unbleached condition, has an extremely greasy feel, enough to lead one to suppose that it would only part with its water with very great difficulty on the paper machine. Unlike most greasy feeling pulp, however the water drains from the machine wire with great rapidity. We have seen the pulp on the wire of the paper machine on five or six occasions. In one case, when making a parchment paper, we observed that the water left the wire quickly after the apron—in fact, in one-quarter of the space taken by a wood-pulp paper made on the same machine at the same speed. This argues in favour of the possibility of comparatively fast running on the paper machine, in spite of the greasy feel and the parchment-like qualities.

"For the purpose of making a comparison of papers producible from the *H. coronarium* with papers with which it is likely to come into competition, we carried out a number of tests as to strength, breaking strain, elongation, bursting strain and greaseproof qualities. These are contained in Table B [not reproduced].

"We draw attention to this fibre as we believe it may become of great industrial importance to the paper trade. Where circumstances are congenial to its growth, the plant spreads to the exclusion of all other vegetable growth by means of its rhizomes, so that it can be harvested at least once a year, producing a heavy crop. It is an easy pulp to manipulate. It is capable of producing a paper of exceptional strength and can be worked either bleached or unbleached. The fact that the paper in its natural state, without the addition of any materials whatever, can be made to possess greaseproof and self-sizing qualities is a point of commercial importance."

Messrs. Clayton Beadle and Stevens also inform us that they have dressed some of the fibre from the green stem, and the tensile strength tests indicate that it is almost exactly similar in strength to the best pure manila binder-twine. Samples both of the paper and the fibre have been presented to Kew and have been placed in the Museum.

Owing to the very remarkable paper-making qualities of *Hedychium* and the ease with which the plant spreads under favour-

able conditions in the tropics, it seems likely that it may be in considerable demand in the near future.

Amomum and Alpinia.

As *Hedychium* has proved to be so valuable a plant for paper-making, stems of *Amomum hemisphericum* and *Alpinia nutans* have also been submitted to Messrs. Clayton Beadle and Stevens for examination as to their paper-making qualities.

In the accompanying report they mention that in neither case do these plants yield papers showing the self-sizing qualities to be observed with *Hedychium* and under certain conditions also with manila waste, bagasse, and also with banana fibre. The Report is as follows :—

"These plants were passed through sugar-crushing rollers for the removal of juices and to reduce same to the condition of tow. They were then boiled under pressure, each with 20 per cent. of soda, the *Amomum hemisphericum* being boiled for 4 hours at 40 lbs. pressure and the *Alpinia nutans* for 6 hours at 50 lbs. They were afterwards bleached, and the yield of unbleached and bleached fibres expressed on the original green weight of stem as received, as follows :—

On green stem as received.	*Amomum.*	*Alpinia.*
Yield—unbleached ...	7·44%	5·93%
bleached ...	6.36	4·95

"If expressed upon the dry weight of stem the figures are as follows :—

On dry stem.	*Amomum.*	*Alpinia.*
Yield—unbleached ...	58·2%	50·0%
bleached ...	49·6	41·5

"The average length of unbeaten fibres as contained in each of the pulps taken as an average of 10 measurements was measured with the following results :—

	Amomum.	*Alpinia.*
Length of fibre	2·54 mm.	2·21 mm.

"From a superficial examination of the pulps in each case we think it possible that the *Amomum hemisphericum* could be made to produce a strong brown paper with a long tear. It is also capable of being bleached white. Very much the same remarks may be said to apply to the *Alpinia nutans*."

From Messrs. Clayton Beadle and Stevens' report it would appear that *Amomum* and *Alpinia*, though considerably inferior to *Hedychium*, might nevertheless be quite useful sources of material for the paper-maker. *Amomum hemisphericum* is a native of Java. *Alpinia nutans* is recorded from Hong Kong, Formosa, Cochin

China, the Eastern Himalaya and the Malay Peninsula. It is also known from the West Indies, Guatemala, Venezuela, Surinam and Brazil, but like *Hedychium* it has probably been introduced into the Western Hemisphere.

Both *Amomum* and *Alpinia* belong to the Natural Order *Zingiberaceae*. Their habit of growth is quite similar to that of *Hedychium*, and it seems probable that *Alpinia* would form dense thickets in swampy country. The stems of *Amomum* reach a height of as much as 16 feet, and those of *Alpinia* are stated to attain to 8 to 10 feet in height.

NOTES ON A CREEPING BEAN.

By E. Hose, Sarawak.

For five years I have been experimenting with various leguminous plants for cover crops.

I find what is required is a low growing leguminous plant which can be dug into the soil and reproduce itself in time to check the growth of weeds.

I have found a small creeping bean which is indigenous to Sarawak of the Vigna family but as yet I have been unable to ascertain its name, and I think it is just possible that it has never been reported from Sarawak.

This bean appears to fulfil all that is required and grows readily from cuttings, but seeds are very difficult to procure.

The flower is yellow and the leaf a rich light green; the roots do not penetrate the ground more than one inch; the plant forms a thick level mass about six inches thick on the ground, it will grow on almost any soil, but for preference a light soil, and in six months after planting should prevent all wash, if planted three feet apart. The trees are ring weeded monthly.

I have been planting this bean with rubber for three years and have now 200 acres planted with it, and it has proved itself in every way a success.

[Note. Mr. Hose has kindly send some cuttings of this bean, which will be tried at the Kuala Lumpur Experimental Plantation. It may then be possible to identify it. From a photograph sent by Mr. Hose, the bean appears to give a low, very close growth, and would appear to be a good cover crop. Ed.]

HOW TO DISTINGUISH DIFFERENT ORDERS OF INSECTS IN THEIR VARIOUS STAGES.

Ichneumons and Other Hymenoptera.

By C. B. Holman-Hunt.

Ichneumons belong to the last group of the Hymenoptera with elongated and exserted ovipositors.

Their life history is as follows. The female Ichneumon flying about catches sight of a caterpillar or the dwelling of a caterpillar on which her particular species is parasitic, (for few Ichneumons are multiparasitic) and she hastens to perch on its back taking a good grip with her claws which are specially adapted for clinging. The caterpillar, which has probably just been moulting, flings itself from side to side and uses any weapons with which it is provided, such as scent-glands in the case of swallow-tail butterfly—or elongated processes in the case of the spiny caterpillars—but, usually without effect. Sometimes the caterpillar bores its way into a tree or spins a tube or case of leaves or even secretes a sweet juice, so that ants tend it and drive away enemies, but rarely does the caterpillar escape from the Ichneumon.

When the caterpillar has ceased to struggle, the parasite lays an egg either just in or on the skin and the irritation starts its prey struggling again; but the Ichneumon is patient, and at last lays either all her eggs in one caterpillar or perhaps only a small proportion of them, and then flies off to recover and to lay more eggs in another victim.

The eggs so placed soon give use to small grubs, which penetrate into the body of the caterpillar and start feeding on the fatty tissues of their prey. The caterpillar goes on feeding voraciously to make up the loss, and for a time nothing seems to be the matter, but at last the parasite comes to the end of the fat and starts feeding on the vital portions and the caterpillar dies. The Ichneumon grub, when it has finished the available food-stuffs, changes into a pupa, and in a few weeks hatches out as a winged insect to continue its course of rapine.

Some Ichneumons lay their eggs in the eggs of other insects, they are of course extremely minute and spend the whole of their larval stage in the egg-shell of their prey.

Others are parasitic on Aphides, for very few insects are free from some forms of these parasites, and they give valuable help to those whose work is devoted to the cultivation of plants.

Some Ichneumons, which are parasitic on the larvae feeding in the wood of trees, are provided with very long flexible ovipositors with which they can reach the grub at the end of its gallery.

Aculeata.

The next group on page 222, is that of the Aculeata or stinging Hymenoptera, although they include some insects that cannot sting. The sexes of the Aculeata can be differentiated by counting the segments of the abdomen which, including the basal small joint, consist of 7 in the female and 8 in the male except in the Chrysididæ, Cuckoo flies. These have only 4 or 5 visible segments. The female of the Aculeata alone can sting.

The first family of the Aculeata is the Pelecinidae and includes that very long and thin-bodied wasp, which may often be caught over young clearings; the length of the body enables it to sting or lay its eggs on the boring larvae of Moths or Beetles, on which it is parasitic.

Next to this come the Chrysididae; as mentioned above, these have only 4 or 5 visible segments. They are of a bright metallic green or blue colour. The largest is just over 1 inch in expanse across the wings. They are called Cuckoo-flies, as they lay their eggs in the nests of other Hymenoptera, generally a solitary wasp or solitary bee, and the grubs feeds on the provisions brought in by the hostess.

The Chrysids possesses a thick skin which the sting of wasps cannot penetrate.

Some of the Chrysididae are true parasites on grubs of Moths or Beetles.

The Ants, Formicina, come next in the group of Aculeata. They are easily recognized by the form of the body and are in no way related to the White-ants wrongly so called *i. e.* the Termites, or to the Velvet Ants or Mutillidae.

In the Formicina or True Ants the first segment of the abdomen, and in some families the second also, is in the shape of a small lense or knot.

Ants usually form colonies consisting of males, females and workers. The males and females are winged, the workers wingless.

The female after her marriage flight tears off her wings and starts a colony. The eggs hatch rapidly and larvae emerge; these rapidly feed up and pupate and come out as workers, which set to work to tidy up the nest and bring in food. These workers are usually of small size and depend in their larvae stage on any food that they can find and are said in some forms to feed on the regurgitated food of the "queen."

The workers are undeveloped females which rarely lay eggs, and the presence of a "queen" is necessary for the continuance of a colony.

Ants often collect and feed scale insects, aphides and beetles and the first two appear to exude sweet excretions which the ants enjoy.

A good key to the Formicidae may be found in Vol, II of the Hymenoptera by Lieut. Colonel C. T. Bingham in the "Fauna of British India" series. This includes many Malayan species.

The Digger Wasps, or Sphecina, next on the list, may be differentiated from the true Wasps by the position of the wings when at rest; in the true Wasps they are folded and in the Digger Wasps they lie flat on the body. From the Bees these insects may be recognized by the shape of their legs, which in the Bees have the basal tarsal joint enlarged for carrying pollen.

The Digger Wasps are all solitary and inhabit burrows or mud cells made or adapted by themselves, in which they lay their eggs and lay up stores of spiders, caterpillars or Aphides, which they have paralysed by a sting, so that they cannot move but remain alive while the Sphex grub eats its way into the fat.

One Indian species, when it has made its semiglobular cell of mud on a wall, carefully carries mud along lines radiating from the centre, apparently to make observers think that a wet piece of mud had been thrown against the wall and that the radiating arms were splashes.

Some of the Pompilidae or Spider Wasps, belonging to the group Sphecina, attach and store up the big Tarantula-like hairy spiders common in Malaya, after biting off their legs.

The True Wasps consist of Guest Wasps, Social Wasps, and Solitary Wasps. Of these the Social Wasps are most interesting. The so-called Hornet of Malaya and India belongs to this division.

The Colonies consist of males, females and workers, of which all are winged. The male Wasps, as mentioned before, do not sting, but it is better not to catch these insects in the hand to count the number of segments, as the stings of even the workers are very painful and a very few can kill a dog, while a man or even a horse is not likely to recover from the stings of a large number.

They usually make their nests out of fibre, which they chew up and convert into a form of papier maché.

Social Wasps are predaceous and feed their young on insects which they have caught.

The two chief genera of Social Wasps here are Polistes and Vespa. In the former the body is long and spindle-shape. In the latter the body is short and with a much more obtuse base. They are clever at building and also repairing their nests.

The Bees or Apina are divided into the

i. Andrenidae or Short-tongued Bees.

ii. Apidae or Long-tongued Bees.

Of these the Apidæ are by far the more important, as they include the Honey Bees, the Dammar Bees, the Carpenter Bees and the Leaf-cutting Bees. Of these the first two are social and the last two solitary.

The Queen bees are larger than the males and the males larger than the workers.

The worker eggs can be developed into Queen bees by improvements in feeding.

The Drones or males are killed off after the swarming.

I have here to acknowledge my indebtedness to the "Manual for the Study of Insects" by Comstock for a great part of these articles and I should recommend those interested to procure a copy of that work. It is published in Ithaca, New York.

The next article will deal with the Coleoptera or Beetles.

MEETING OF THE PLANTERS' ASSOCIATION OF MALAYA AT PENANG, ON JANUARY 6TH, 1913.

Present.

Mr. E. Macfadyen (in the Chair).
Mr. H. C. E. Zacharias (Secretary).
and the following delegates :—

Mr. F. G. Souter, Mr. E. D. Money } from Kuala Selangor D. P. A.
Mr. J. D. McCulloch, ,, T. W. Stewart, ,, G. H. Cater } from Negri Sembilan P. A.
,, C. Burn Murdoch — from Kajang D. P. A.
,, R. Pears — ,, Johore Pl. A.
,, G. H. Gutteridge — ,, Malacca P. A.
,, M. Maude, ,, H. J. Cooper — ,, Lower Perak D. P. A.
,, J. G. Cruickshank — ,, Kapar P. A.
,, J. Kennedy, ,, W. Duncan — ,, Malay Pen. Agr. Ass.

also Mr. L. Lewton-Brain, Dir. Agr., F.M.S., Hon. Member.

1. The Minutes of the Meeting held on Nov. 17th are considered and on the motion of Mr. Gutteridge, seconded by Mr. Duncan, confirmed and duly signed by the Chairman.

New York Exposition.

2. The Secretary reads letters he has addressed to Messrs. C. Baxendale and L. Wray thanking them for their valuable work in connection with the Exposition.

Mr. Lewton-Brain reports on the locally incurred expenditure, which had amounted to $3,206.05. This sum had been met as follows:—

Contributions from Estates:		
Windsor Estate	$25.—	
Kuala Selangor „	25.—	
Bidor Rubber „	25.—	
Kuala Lumpur Rubber Co., Ltd.,	500.—	
Jebong Estate	50.—	
Shelford „	25.—	
Balgownie „	100.—	
		750.—
Treasurer F.M.S. Government		2,456.05
		$3,206.05

The *Secretary* submits draft of a further appeal to be signed by the Chairman and circularized amongst all members of Constituent Associations.

Ghent Exhibition.

It was decided that the Association, following the example of the Selangor Chamber of Commerce, should not participate as an Association in this Exhibition but should wait for the San Francisco exhibition.

Telephones at Railway Stations.

A letter was read from the Under Secretary asking which Stations should, in the opinion of the Association, be connected with the telephone exchange.

Mr. Macfadyen reports that the deputation appointed at the last meeting had received a very sympathetic hearing from the Chief Secretary and he would now suggest that the Government be replied to to the effect that the Railway Stations of all town-ships having a telephone exchange should be connected.

Repression of Drunkenness.

The *Secretary* reads the following letters:—

Kajang,
16th December, 1912.

The Secretary,
Planters' Association of Malaya.

Dear Sir,

A case has been brought to my notice in which the end of the law prohibiting the sale of Gin to Tamils has been set at naught. As far as I can see there is nothing to prevent a constant repetition

of such instances and I should be glad if you would ask our legal adviser what steps he would advise.

The case is roughly as follows :—

Mr. Wilton, Assistant on Belmont Estate, caught a rickshaw on the estate with 6 full bottles of Gin in it. The rickshaw puller said he was taking it to a cooly on the estate. The cooly owned to the Gin. We thought we had a clear case against the gin shop, but on enquiry it is found that the cooly gave money to the rickshaw puller to buy the gin. The gin shop therefore was entitled to sell the gin. Of course the rickshaw puller could have been run in for selling to the cooly but the Inspector of Police advised not running him in as he would only get a fine of $4 or $5.

Yours faithfully,
KAJANG DISTRICT P. A.
C. Burn Murdoch,
Chairman.

Kuala Lumpur,
18th December, 1912.

Dear Sir,

I have considered the letter dated 16th December, you received from the Kajang District Planters' Association and it seems to me that unless it can be proved that the Shopkeeper know that the rickshaw puller was buying the liquor as the agent for a Tamil cooly, no action can be taken in Court; but I have seen the Chairman of the Licensing Board who says that if two or three instances can be given to him of any one shop-keeper selling liquor to an agent of a Tamil cooly then he will do his best to persuade the Licensing Board to cancel the license of the Shop-keeper.

Yours faithfully,
(Sgd). G. Harold Day.

The Secretary,
Planters' Association of Malaya.

Mr. Macfadyen considers that the importance of the issue merited well some personal inconvenience and trouble, and urged all members to take private action, even if only small fines were imposed. In fact, he thought the matter one which out to be taken up strongly by all local Associations.

Mr. Cater remarks that the difficulty lay in getting witnesses.

Mr. Gutteridge reminds the meeting that the S.S. Government had not yet introduced any analogous legislation, as promised, and suggested that the Secretary again write in about it.

This is agreed to.

HONORARY MEMBER.

Mr. Macfadyen proposes, Mr. Duncan seconds and it is passed unanimously that Mr. Leonard Wray, I.S.O., be made an Honorary Member of the Association.

Railway Ambulance.

The *Secretary* reads the following letter :—

Kuala Lumpur,
Federated Malay States,
Sir, 23rd December, 1912.

I am directed by the Chief Secretary to inform you that he has had under consideration the question of providing a railway ambulance, a question which was submitted for his consideration by a Deputation of the Planters' Association of Malaya on the 3rd December. It appears that the cost of an ambulance car would be about £2,500 and it would seem that one car would be probably of little use as it might be impossible to obtain it soon enough when it was wanted.

2. The Chief Secretary is informed that in England stretcher cases are accomodated in one of the passenger brake-vans but if there is objection to this being done on the Federated Malay States Railways instructions will be issued to the effect that at stations where there is a motor dock, on production of a signed requisition from the Medical Officer to the Station Master, a coach will be shunted into the motor dock siding so that the patient may be carried into the coach from the dock.

3. This will involve breaking up the train and will cause a delay of half an hour besides probably causing delay to other trains and it is hoped therefore that the concession will be used as little as possible and only in cases where it is considered absolutely necessary that a patient shall be carried into the coach.

I have, &c.,
(Sgd.) J. F. Owen,
The Secretary, Ag. Under Secretary, F.M.S.
The Planters' Association of Malaya.

Mr. Macfadyen considers that the Government had met them very reasonably and that they could hardly expect any greater concession.

Mr. Souter agrees and proposes that the Government be thanked.

Mr. Gutteridge seconds and the motion is carried unanimously.

Labour Code.

The *Secretary* reads a letter from the General Manager Oriental Rubber Co., forwarding a letter from "The Labour Association Ltd.," and suggesting that if the Labour Association fulfil their promises they can only do so by organised crimping at the coast. The Secretary is instructed to refer the correspondence to the Indian Immigration Committee.

Javanese Labour.

Mr. Cooper says that the alternatives before the Association were either that they should start a bureau of their own in Java or else appoint an existing labour bureau as their agents. He was strongly in favour of the latter and was sure that if this was done prices would be considerably reduced.

After some discussion it was decided that Messrs. Maude and Cooper be asked to continue as a Sub-Committee to enquire into the rival claims of various firms and carry on negotiations.

A hearty vote of thanks to Messrs. Maude and Cooper for all the work they had already done in this connection was carried with applause.

Estate Dressers.

Mr. Cater proposes that the Scheme submitted by the P.M.O. be adopted, provided probationers are required to enter into a bond to serve an estate for two years, before the estate deposits $400.

Mr. Pears seconds the proposal, which is carried unanimously.

Affiliation.

The Secretary reads a letter from the Secretaries of the Singapore Planting Association applying for membership in the Planters' Association of Malaya.

The affiliation is agreed to with acclamation.

New Rules.

Mr. Macfadyen proposes on behalf of the Standing Committee that Rules 4 and 5 be deleted and the following be sustituted :—

4. "The Association shall consist of the Chairman for the "year of the Planters' Association of Malaya and of "delegates from Constituent Associations.

5. "Each Constituent Association shall be represented by one "in ten or part of ten of their members provided that the "Standing Committee shall have the right in its discretion "to reduce the number of such representatives from any "Constituent Association at their request for the current "year."

This is agreed to unanimously.

Mr. Macfadyen then proposes the following additional Rules :—

"(*a*) The Chairman of the Association shall hold office for "one year only, but shall be eligible for re-election.

"(*b*) Candidates for the Chair must be nominated by a "Constituent Association which shall forward such nomination to "the Secretary not later than the 15th of March,

"(*c*) The names of candidates duly nominated shall be placed "on the Agenda for the Annual General Meeting and only such "candidates shall be eligible. Provided that should no candidate "have been nominated, as aforesaid, the Annual General Meeting "shall elect the Chairman for the ensuing year.

"(*d*) Voting for the election of the Chairman shall be by "voting papers issued at least 15 days before the Annual Meeting to "all Constituent Associations in accordance with the number of "their members."

Mr. Cruickshank proposes that "any member" be substituted in sub-section (*b*) after, "nominated by" for "a Constituent Association."

This amendment failing to find a seconder, the original motion is put to the meeting and carried with one dissentient.

Federal Council.

Mr. Cruickshank proposes "that this Association be allowed to submit a name for the approval of H. E. the High Commissioner as the Planters' Representative on the Federal Council." He points out that this Association was now a most representative body indeed, covering practically every part of the Planting Industries of the Malay Peninsula and Colony, and although during the past they had had no reason to grumble about the various members that Government had thought right to nominate as members of the Council, they still felt that they had a right to ask that they might select their own representatives. It might so happen they had a member on the Council who was not quite in sympathy with the whole planting community. Knowing who their member was District Associations could write to him on subjects affecting their local wants if necessary. At present, he thought he was right in saying the planter who was on the Council was hardly a representative of the planting community, inasmuch as he was nominated by the Government and might not happen to be a member of the Planters' Association.

He did not think they were asking too much in going to Government and saying they wish to be represented by their own balloted-for member. He believed that the question had been brought forward before and Government had said "No," but there was no reason why previous Governments and previous Governments' policies should apply to the present day. In other countries where agricultural interests were represented on the Councils the members were nominated by the Planters' Association, It was so in Southern India and, till latterly, in Ceylon where they had now provided for a rural member, who was really the Planters' member, voted for by the planting community.

Mr. Duncan; seconds the motion, which is carried unanimously. The Meeting terminates at 1 p.m.

(Sgd.) H. C. E. Zacharias,
Secretary.

NOTES ON THE SINGAPORE MARKET FOR STRAITS PRODUCE DURING JANUARY 1913.

The Principal European and American markets continue dull with very little speculative interest taken in forward business, and until political affairs are in a more settled condition, any improvement is unlikely :—

Black Pepper.—Supplies were small until last week when the new Johore crop began to come in, of which about 250 tons have been sold at $19.5/8 to $19.80.

White Pepper.—The usual trifling quantities of Sarawak have arrived, realizing $33¼ to $33¾, and supplies of other grades have also been on the smallest possible scale. Moderate stocks are said to be held by Chinese, but no supplies of any consequence can be expected for some months to come.

Gambier.—Demand in Europe and America has been unusually quiet, and as stocks in these markets appear more than sufficient for requirements, the price has declined to $7.50 at which there are few buyers.

Cube Gambier.—Is also weaker, sales having been made of "Fair Unpicked" at $13 and Malacca wet Cubes at $12¼.

Copra.—The small shipments from the Straits and Manila during December have stimulated the market which has advanced very considerably during the month, with a strong demand for ready Copra. Closing values are—Bally $12.40, Kayong $12, Pulo $11.90, and Siantan $11.80.

Rubber.—Has been a fairly strong market, but at the close is easier on lower advices from London.—Closing values are as follows :—

Fine Pale Crepe	$242.
No. 2 ,,	230.
Smoked Sheet	238/225.
Unsmoked Sheet	231/215.
Scrap	170/140.

Tapioca.—Has declined and market closes dull at $7.30 for Flake and $6.45 for Medium Pearl.

Nutmegs.—Are practically unchanged with very little business passing

Sago Flour.—Has gradually declined and with the more favourable weather now prevailing supplies are coming out freely. Closing prices are $3.85/3.60 according to quality.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported during the Years 1912 and 1911.

Produced in	Exported during Dec. 1912.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.
	lbs.	lbs.	lbs.	lbs.	lbs.
Perak	1,177,672	9,292,617	10,470,289	5,553,277	4,917,012
Selangor	1,783,249	16,116,889	17,900,138	10,487,916	7,412,222
Negri Sembilan	721,015	5,509,808	6,230,823	3,615,174	2,615,649
Pahang	11,993	104,772	116,765	38,963	77,802
Total ...	3,693,929	31,024,086	34,718,015	19,695,330	15,022,685

Exported viâ	To United Kingdom.		To Continent of Europe.		To Ceylon.		To America.		Total.	
	Dec.	To date.	Dec.	To date.	Dec.	To date.	Dec.	To date.	Dec.	To date
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Port Swettenham	1,557,148	16,725,646	202,071	2,306,584	107,307	902,442	...	23,413	1,866,526	19,958,085

Note :— To Australia and Japan nil.

KUALA LUMPUR,
11th January, 1913.

W. J. P. HUME,
Commissioner of Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the Month of December, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bharu	...	143.2	78.8	83.19	74.	9.19	75.5	.818	73.2	83.	...	15.00	2.41
Malacca, Durian Daun Hos.	29.888	144.9	80.6	86.2	72.1	14.1	77.6	.906	...	87.	N. W.	8.77	2.10
N. Sembilan, Dist. Hospital Seremban	...	142.3	78.5	87.0	70.6	16.4	75.2	.819	73.1	83.	N. E.	6.74	1.32
,, Dist. Hos. K. Pilah	...	161.8	80.3	88.8	72.	16.8	77.1	.867	74.8	83.	...	9.65	1.42
,, ,, Tampin	...	134.3	77.9	85.	73.	12.	73.5	.763	71.	79.	...	6.79	1.00
,, ,, P. Dickson	...	159.6	80.4	86.6	73.5	13.1	76.4	.837	73.7	79.	...	6.01	1.28
Pahang, ,, K. Lipis	...	...	78.3	86.5	67.1	19.4	74.3	...	...	...	...	9.62	1.65
Penang, ,, Penang	29.849	152.	81.9	90.5	71.0	19 5	76.4	.833	72.7	77.4	...	3.88	1.15
Perak, ,, Taiping	...	105.	79.49	91.0	70.0	21.0	75.97	.849	...	84.	...	21.25	5.75
,, ,, Ipoh	...	...	80.67	91.0	69.0	22.0	76.03	.837	...	80.	...	10.59	2.19
,, ,, T. Anson	...	...	80.70	90.0	70.0	20.0	77.01	.881	...	85.	...	14.69	1.73
,, ,, P. Buntar	...	...	80.55	91.0	70.0	21.0	76.21	.848	...	82.	...	10.52	3.42
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	15.36	1.56
Selangor, General Hospital Kuala Lumpur	...	145.5	80.4	87.7	71.6	16.1	76.6	.845	74.1	80.	...	11.95	3.49
,, Dist. Hos. Klang	...	...	...	85.3	67.2	18.1	...	...	...	...	...	8.90	1.57
,, ,, K. Selangor	...	...	...	87.8	69.9	17.9	...	...	...	...	...	9.35	2.52
,, ,, Rawang	...	...	...	89.9	71.2	18.7	...	...	...	...	...	10.72	2.40
Singapore, Kandang Kerbau Observatory	29.569	159.8	80.2	90.0	72.0	18.0	76.7	.872	...	85.	N. E.	18.46	3.22